GHASP: an Hα kinematical survey of spiral galaxies - XI. Distribution of luminous and dark matter in spiral and irregular nearby galaxies using WISE photometry.

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ABSTRACT

We present the mass distribution of a sample of 121 nearby galaxies with high quality optical velocity fields and available infra-red *WISE* 3.4 μm data. Contrary to previous studies, this sample covers all morphological types and is not biased toward late-type galaxies. These galaxies are part of the Fabry-Perot kinematical *GHASP* survey of spirals and irregular nearby galaxies. Combining the kinematical data to the *WISE* surface brightness data probing the emission from the old stellar population, we derive mass models allowing us to compare the luminous to the dark matter halo mass distribution in the optical regions of those galaxies. Dark matter (DM) models are constructed using the isothermal core profile and the Navarro-Frenk-White cuspy profile. We allow the M/L of the baryonic disc to vary or we keep it fixed, constrained by stellar evolutionary models (WISE W_1-W_2 color) and we carry out best fit (BFM) and pseudo-isothermal maximum disc (MDM) models. We found that the MDM provides M/L values four times higher than the BFM, suggesting that disc components, on average, tend to be maximal. The main results are: (i) the rotation curves of most galaxies are better fitted with core rather than cuspy profiles; (ii) the relation between the parameters of the DM and of the luminous matter components mostly depends on morphological types. More precisely, the distribution of the DM inside galaxies depends on whether or not the galaxy has a bulge.

Key words: Galaxies: nearby - galaxies: halos - galaxies: kinematics and dynamics - galaxies: spiral and irregular - dark matter

- In the present paper, we use the rotation curves published in Epinat et al. (2008b), who also provide a global view on the full GHASP sample

  (FP, Haute Provence).
- We use a sample of 121 spiral and irregular nearby galaxies for which accurate H rotation curves, derived from 2D velocity fields, and WISE infrared surface photometry were available.

- Log ($M_{stellar}/L_{W1}$)
- = -2:54(W1 -W2) – 0.17

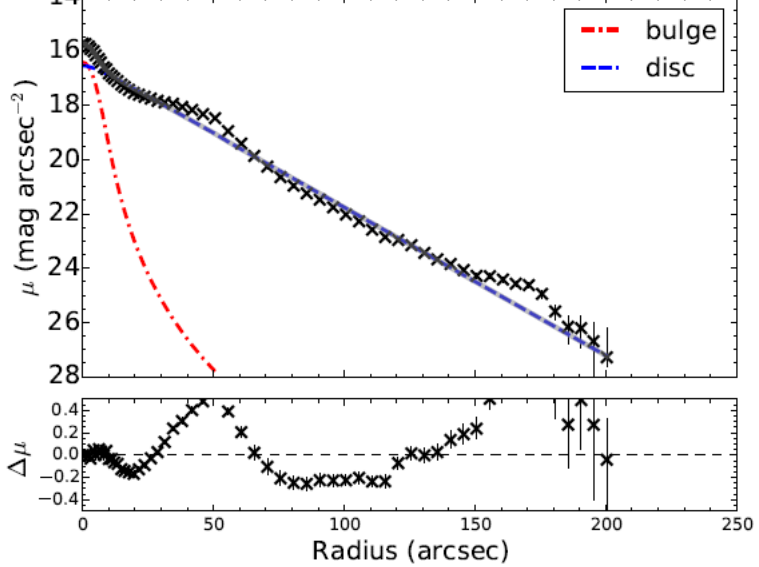
(Cluver et al, 2014.)

Компоненты:

экспоненциальный диск

+ балдж Сersика,

для SB – ещё бар.



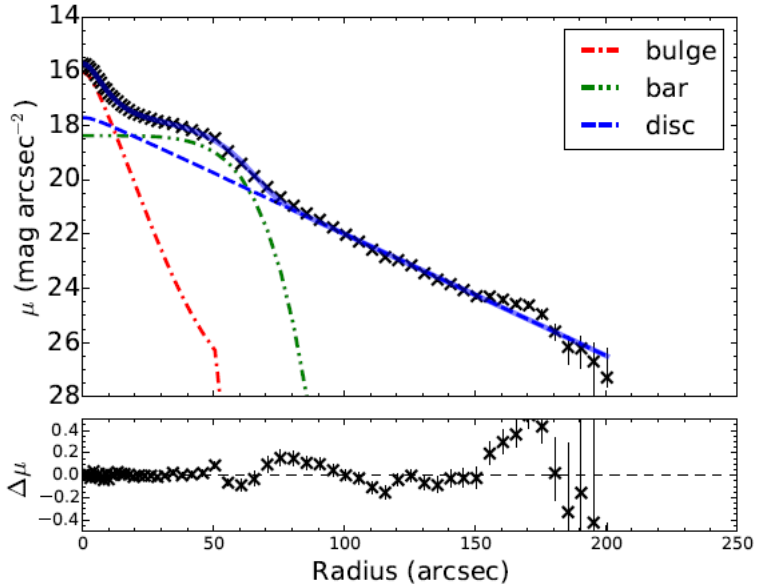
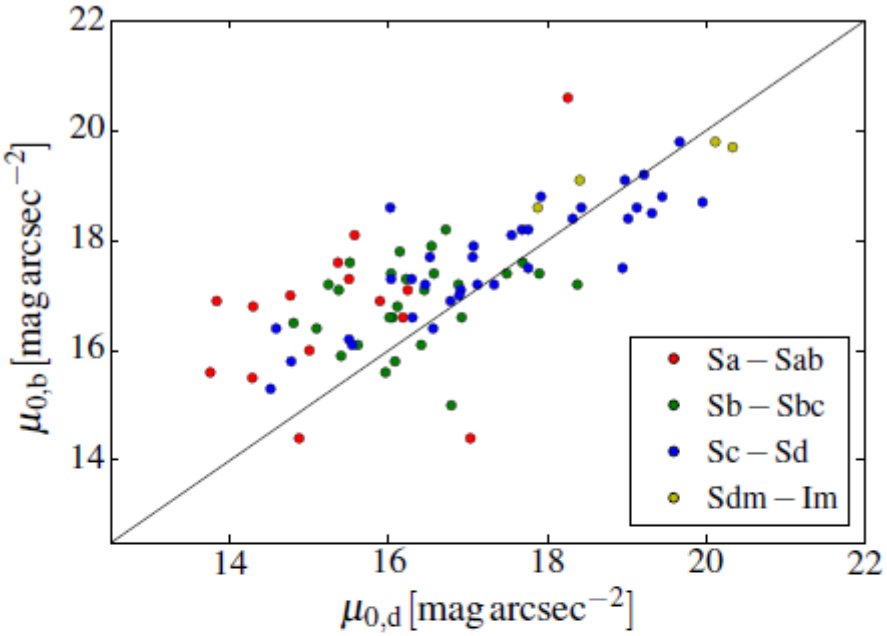
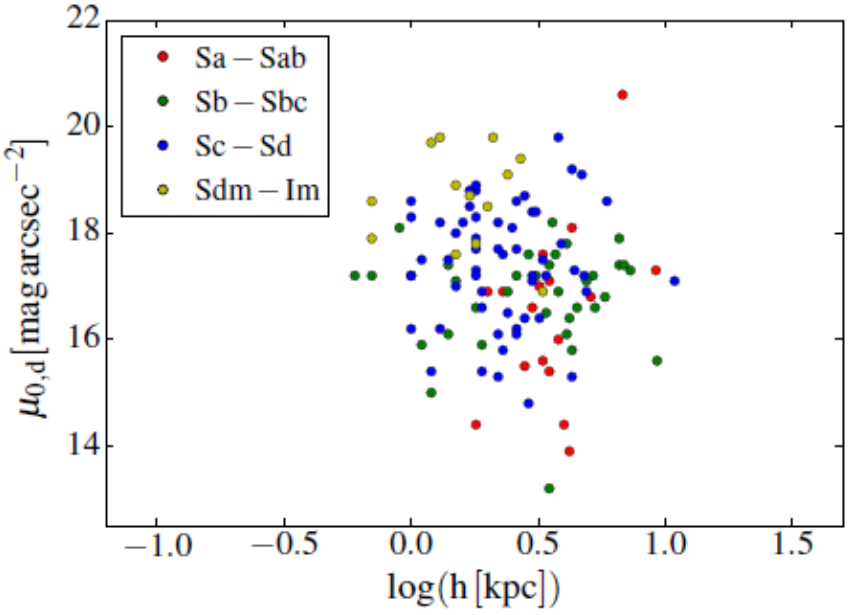
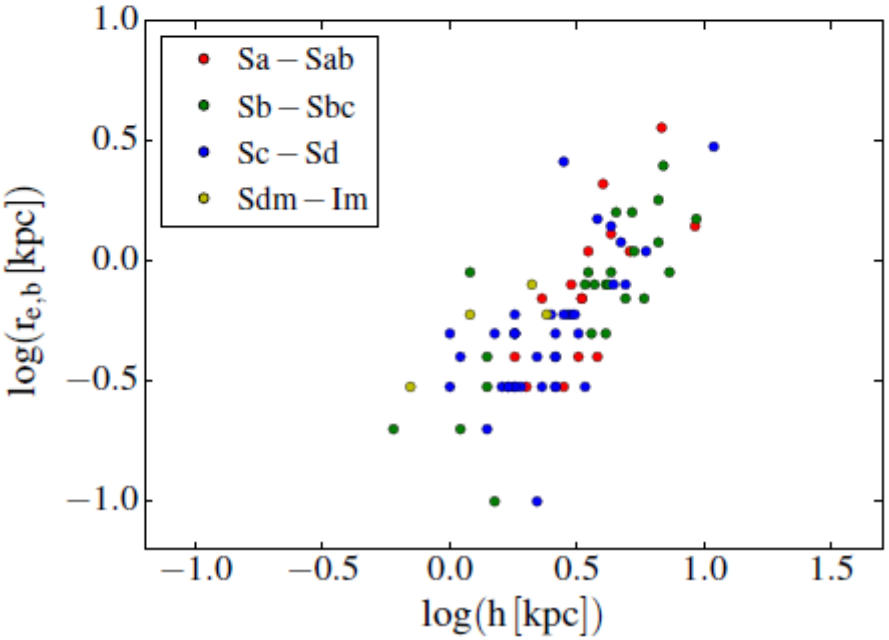


Figure 2. Example of the structural decomposition of UGC 8900 in the W_1 band without including a bar component (top panel) and including a bar component (bottom panel). The observed surface brightness profile in plotted using black cross and the different components bulge, disc, bar (bottom panel) in red, blue and green dash lines respectively. The lower subpanel represents the fitting residuals, which are obviously reduced when a bar is included in the model.







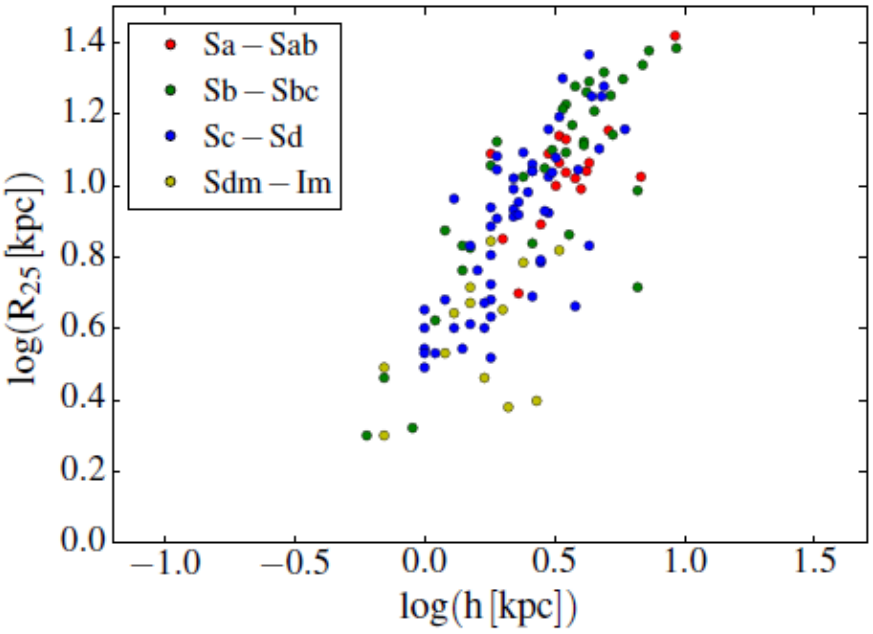


Figure 3. Correlations between parameters derived from the W1

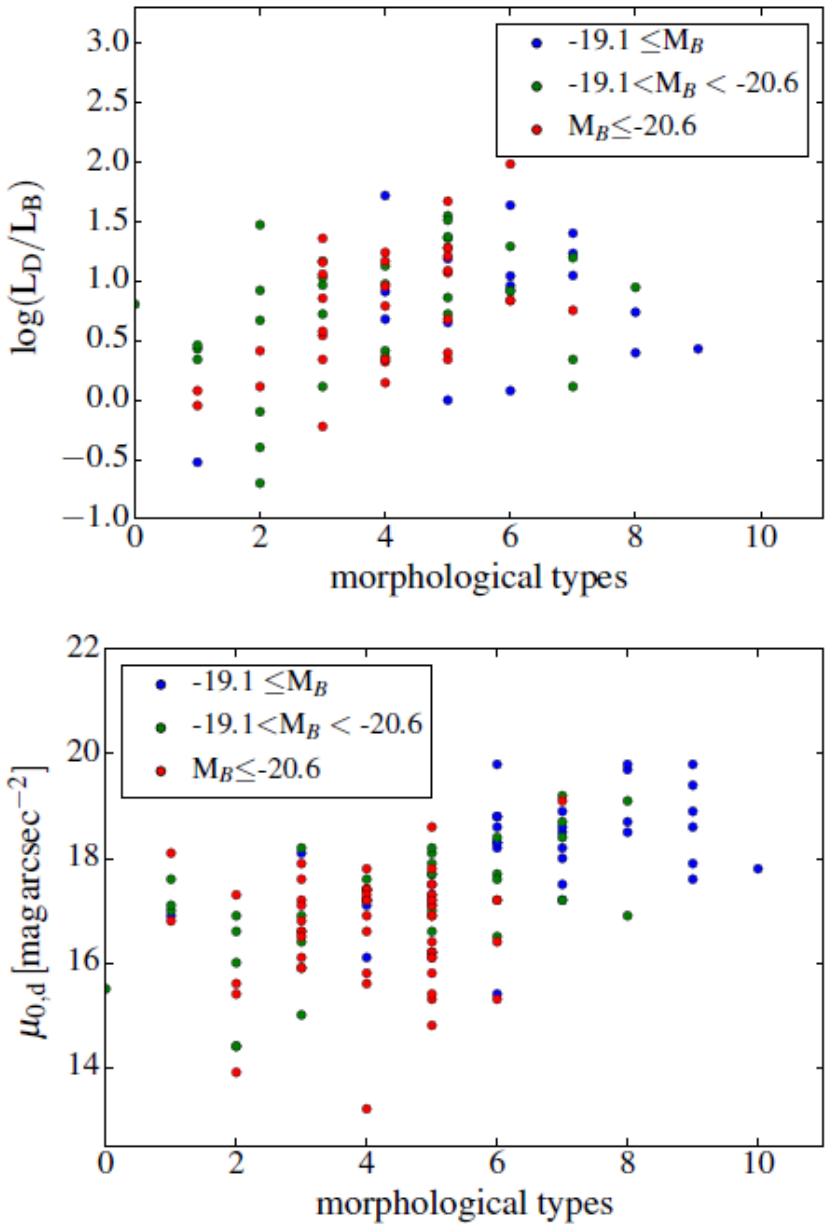
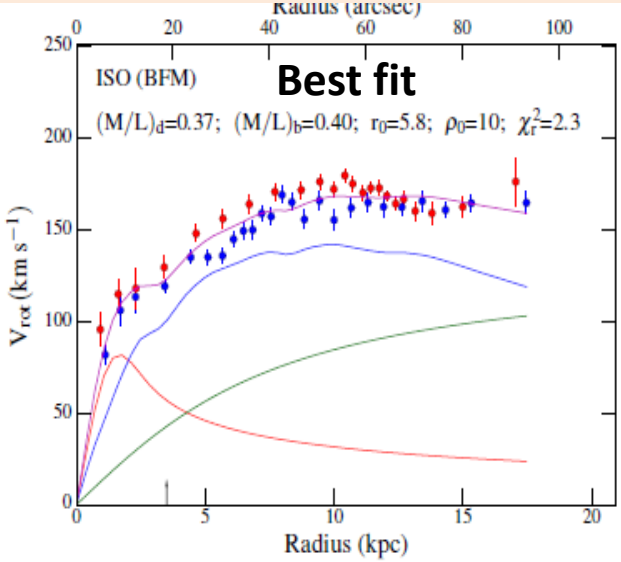
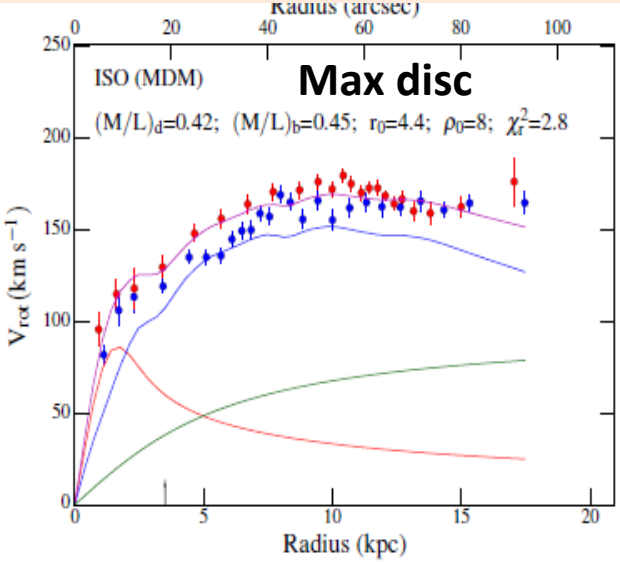
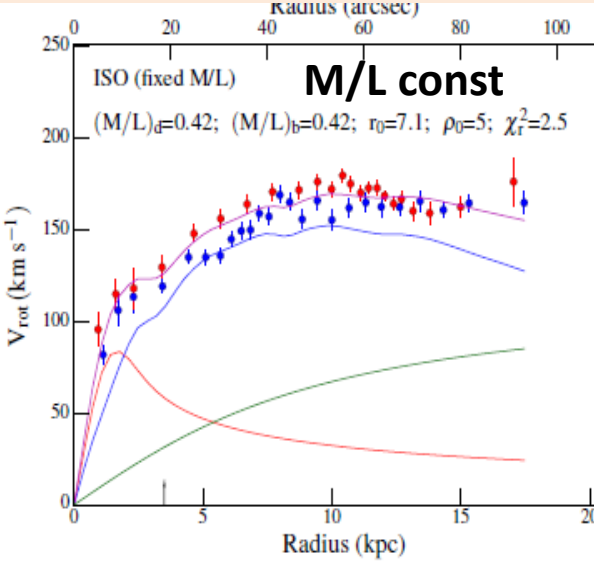


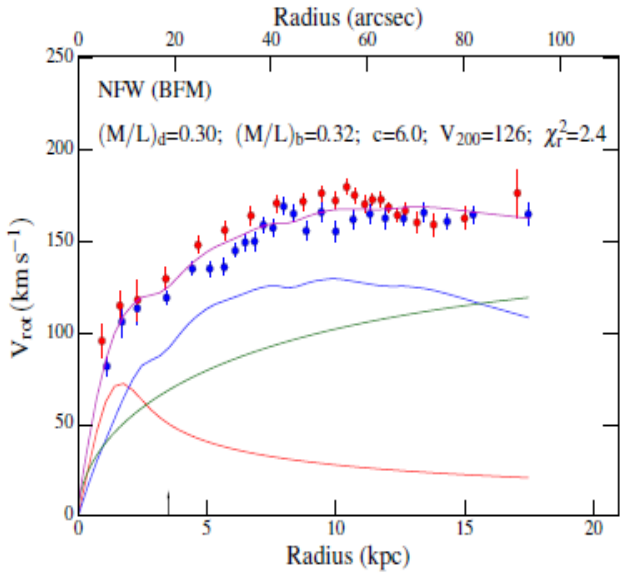
Figure 4. From the top to the bottom panel: disc luminosity, bulge luminosity, ratio of disc-to-bulge luminosity and the central disc surface brightness versus the morphological types.

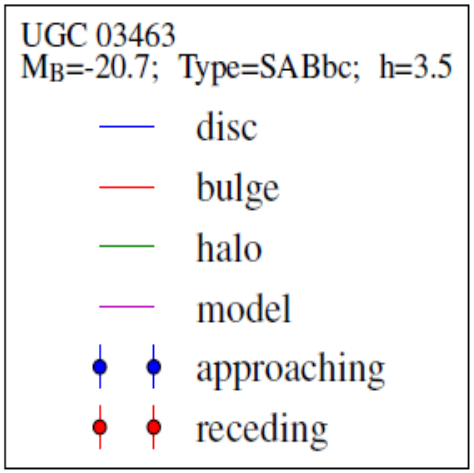
UGC3463

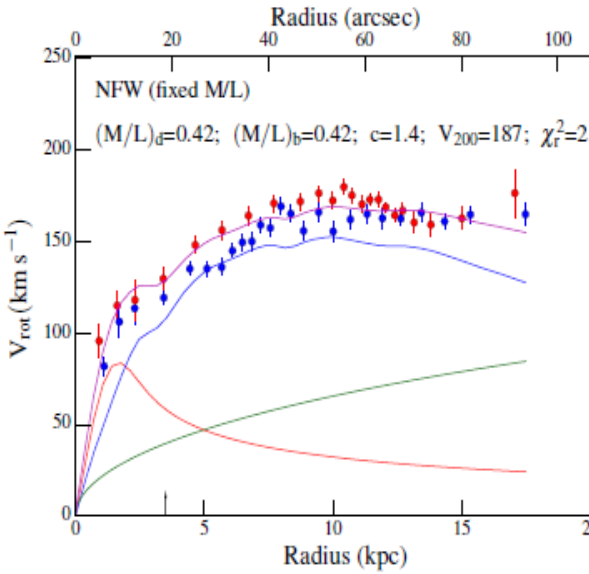

Radius (arcsec)
ISO (BFM)
Best fit
$(M/L)_d$=0.37; $(M/L)_b$=0.40; r_0=5.8; ρ_0=10; χ^2_r=2.3
V_{rot} (km s^{-1})
Radius (kpc)


Radius (arcsec)
ISO (MDM)
Max disc
$(M/L)_d$=0.42; $(M/L)_b$=0.45; r_0=4.4; ρ_0=8; χ^2_r=2.8
V_{rot} (km s^{-1})
Radius (kpc)

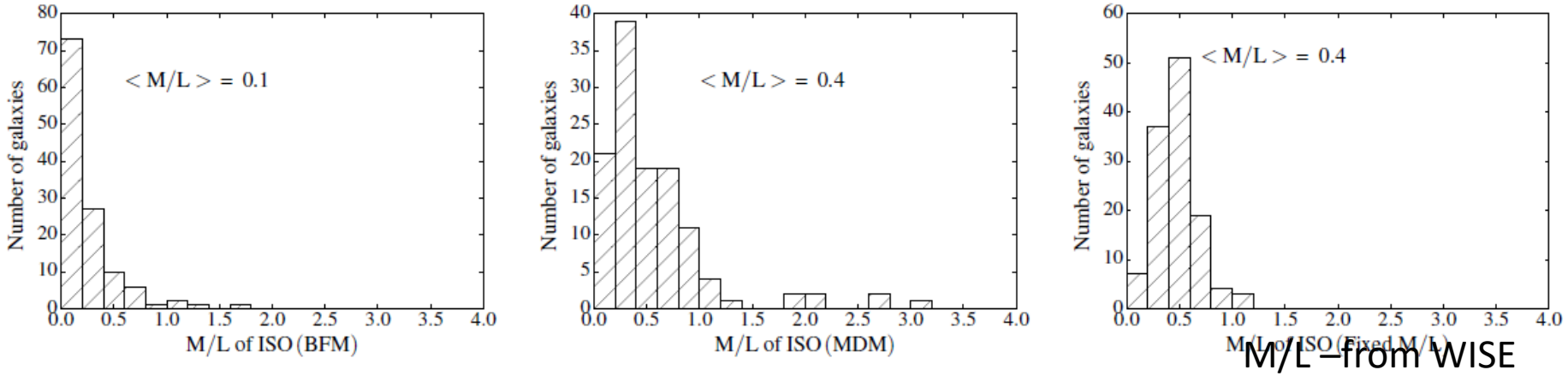

Radius (arcsec)
ISO (fixed M/L)
M/L const
$(M/L)_d$=0.42; $(M/L)_b$=0.42; r_0=7.1; ρ_0=5; χ^2_r=2.5
V_{rot} (km s^{-1})
Radius (kpc)


Radius (arcsec)
NFW (BFM)
$(M/L)_d$=0.30; $(M/L)_b$=0.32; c=6.0; V_{200}=126; χ^2_r=2.4
V_{rot} (km s^{-1})
Radius (kpc)


UGC 03463
M_B=-20.7; Type=SABbc; h=3.5
disc
bulge
halo
model
approaching
receding


Radius (arcsec)
NFW (fixed M/L)
$(M/L)_d$=0.42; $(M/L)_b$=0.42; c=1.4; V_{200}=187; χ^2_r=2
V_{rot} (km s^{-1})
Radius (kpc)

Распределение по отношению M/L

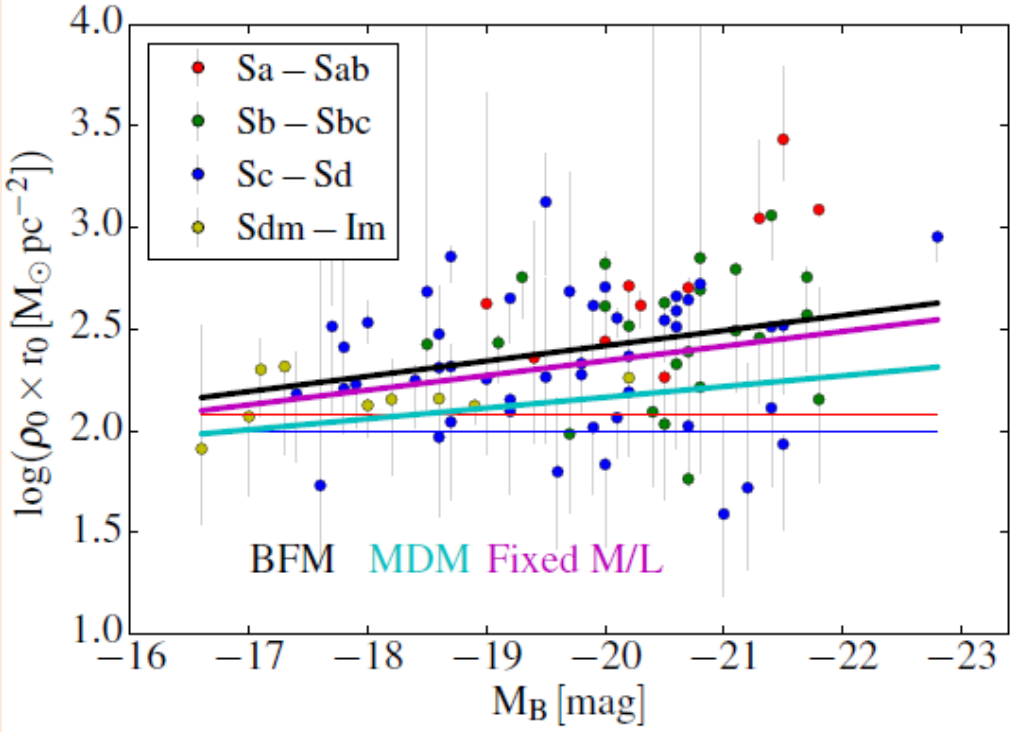


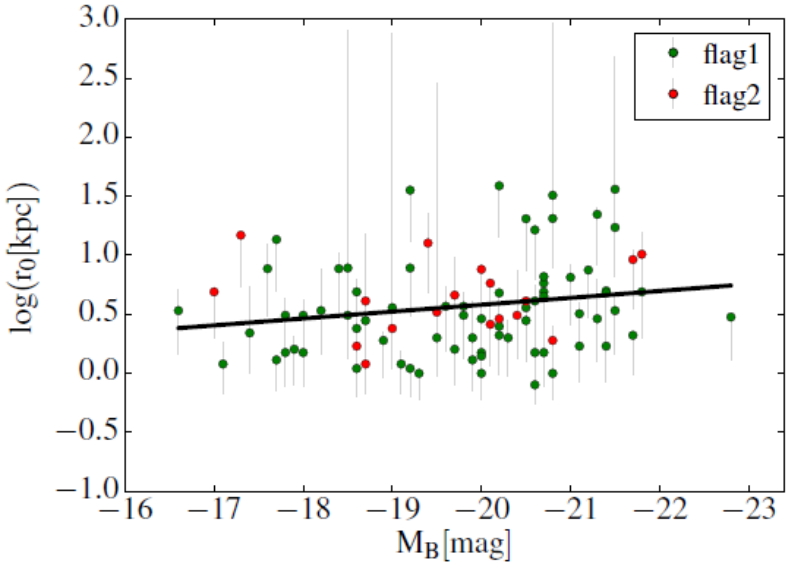
M/L –from WISE

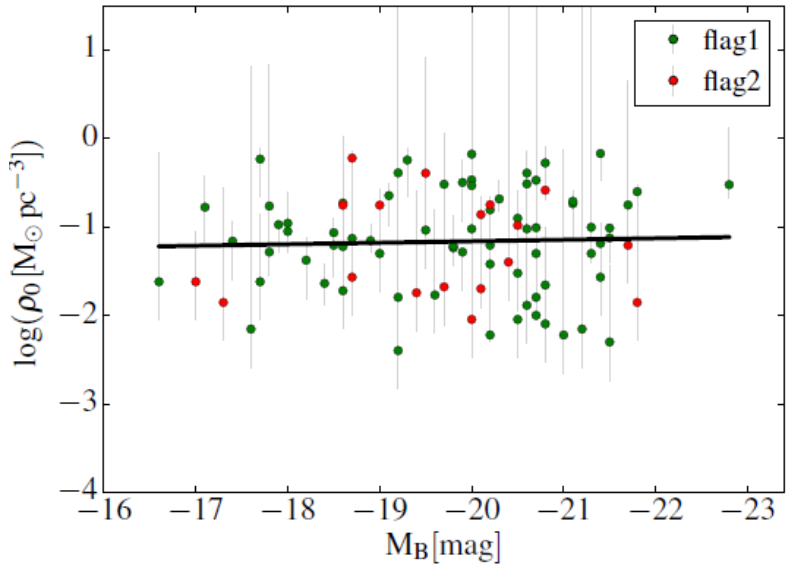
Figure 6. Mass-to-light ratio distribution from the pseudo isothermal sphere model (ISO). From left to right: for the best fit model (BFM), for the maximum disc model (MDM) and for the M/L fixed using the WISE color (W_1-W_2). The median <M/L> values are indicated in the plots for each case.

ПАРАМЕТРЫ ТЁМНОГО ГАЛО

Сравнение с рез-тами Randriamampandry T. H., Carignan C., (red) 2014 и Kormendy & Freeman (2004) (blue)







gure 9. Halo scaling radius (top panel) and central halo density (bottom nel) versus the absolute magnitude for all the sample from the ISO (BFM) odels. The green symbols represent the higher quality rotation curves (flag while the red circles show the lower quality rotation curves (flag 2). The ick line linearly fits the dots.

Основные выводы

- For ISO with maximum disc fit, the M/L values are similar to the M/L obtained from the (W1-W2) color. This suggests that discs tend to be “maximum”.
- The trend between ρ_0 and r_0 does not depend on morphological types.
- The relation between the dark halo parameters and the luminosity of the galaxies seems dependent on the morphological types.
- We also checked whether the presence of a bar could impact the observed DM correlations and found not convincing trend.